

## Lead Scientist's Report

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**Summary:** This report includes seven items: (1) Summary of a recent article from *San Francisco Estuary and Watershed Science* on the invasive overbite clam; (2) Summary of one brown bag seminar on abandoned and derelict vessels in the Delta; (3) Summary of one poster from the 2017 Delta Invasive Species Symposium; (4) Summary and highlights from the workshop on structured decision making (SDM); (5) Update on Operation Baseline; (6) Announcement of the Delta biotelemetry workshop; and (7) the By the Numbers Report.

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### Summary of a Recent Article from *San Francisco Estuary and Watershed Science*

**Long-term Surveys Show Invasive Overbite Clams (*Potamocorbula amurensis*) are Spatially Limited in Suisun Marsh, California.** Baumsteiger, J.; Schroeter, R. E.; O'Rear, T. A.; Cook, J. D.; Moyle, P. *San Francisco Estuary and Watershed Science*, 15(2). July 2017.

<http://escholarship.org/uc/item/6fd377s4>

Ballast waters from ships are responsible for the transmission of hundreds of invasive species from various countries around the world to the Bay-Delta. The overbite clam, the most abundant of three invasive clam species introduced via ballast water, was discovered in the San Francisco Estuary around 1986 and in Suisun Marsh in 1988. Among other issues, this invasive clam has caused major disturbances to estuarine food webs as a result of its efficient filtering capabilities. The overbite clam has outcompeted native zooplankton (such as copepods and krill) and fish for their common food source of phytoplankton (a microscopic algae), contributing to declines in native species, including delta smelt, and non-native striped bass. This decline of fish and other pelagic species, referred to as the pelagic organism decline (POD), occurred four years after the overbite clam was first detected in the San Francisco Estuary. While the overbite clam has successfully exploited habitats in the San Francisco Estuary, studies have found that they are limited by predation, as well as low levels of salinity.

This study focused on populations of the overbite clam in Suisun Marsh, located between San Francisco Bay and the Delta. Researchers sought to answer three foundational questions: 1) What are the long-term abundance patterns of overbite clams; 2) What is their spatial distribution and how has it shifted over the years; and 3) What environmental parameters (such as temperature and salinity) govern their abundance? To answer these questions, researchers utilized data from a long-term fish monitoring project, including data spanning 27 years (1988-2015), from 17 stations throughout Suisun Marsh. Analysis of the data revealed that overbite clam abundance in the marsh has increased substantially since they were first detected. Researchers also found that the overbite clams are spatially limited in their distribution and are found primarily in a single large tidal slough in Suisun Marsh. This implies that the shallow interior channels are unlikely to provide suitable habitat. The clams were more abundant in spring and summer months when the water was warmer and saltier. Overbite clam abundance was also higher in areas where dissolved oxygen (DO) in the water was higher.

Researchers proposed that the distribution of the overbite clam in Suisun Marsh is affected by connectivity to large channels and Suisun Bay, the abundance of detritus (large pieces of dead and decomposing vegetation commonly found in the smaller sloughs impact the clams' ability to filter-feed and decrease the amount of DO in the water), and predation on clams by some fishes (e.g., White Catfish). Results from this study have implications for the design and location of future restoration projects in Suisun Marsh. Climate change also could have impacts on future clam abundance because it will likely bring warmer waters to the area, serving as a potential mechanism to increase the abundance and range of the invasive overbite clam.

**Brown Bag Seminar: *Exploring the Issue of Abandoned Derelict Vessels in the Sacramento-San Joaquin Delta* – Annie Daly, Masters Candidate at UC Santa Barbara's Bren School/ Intern with the California Department of Fish and Wildlife's Office of Spill Prevention and Response (OSPR)**

Abandoned derelict vessels (ADV) are a major issue in the Delta. Abandoning vessels is more common than it might seem, as many owners are unaware of the costs of upkeep, maintenance, and the correct disposal of their vessels. In addition to being an eyesore, ADVs pose a threat to the safety of waterways for recreational and commercial boaters, often leak oil and harmful chemicals, and damage sensitive aquatic habitat. For this brown bag seminar, Annie Daly presented her internship project with the California Department of Fish and Wildlife's Office of Spill Prevention and Response on abandoned or derelict recreational and commercial vessels in the Delta. Through her internship project, Daly estimated 237 ADVs in the Delta, with 78 percent being recreational vessels of various sizes (i.e., from kayaks to houseboats). Daly also estimated that on average two new commercial vessels are abandoned every year in the Delta.

Daly identified ADVs via aerial surveys, which provided information on seasonal patterns of abandonment and location hotspots in the Delta. In addition to providing an estimate of the number of both commercial and recreational vessels in the Delta, the survey also identified the vessels' status as either floating, sunk, partially submerged, or upside down. Using data from aerial and water surveys, Daly estimated the cost of ADV removal based on multiple factors: accessibility, ADV status (sunken vs. floating), hull material, depth, and distance to the nearest landfill. She computed a rough cost estimate of \$15 million to remove the 52 commercial vessels identified in aerial surveys.

Daly explained that there is a network of federal and State agencies, including the U.S. Army Corps of Engineers and the California State Lands Commission, that can help address different facets of the ADV problem. The largest obstacle to the removal of ADVs, however, is a lack of funding. While there are multiple agencies tasked with addressing this issue, there is no overarching program or funding dedicated to solving the problem, especially for commercial vessels. Despite this challenge, Daly highlighted successful programs and resources currently available. For example, the Division of Boating and Waterways' (DBW) Surrendered and Abandoned Vessel Exchange (SAVE) and recreational vessel turn-in programs. SAVE provides local agencies with grant money to remove and deal with recreational vessels, with funding from registration fees for recreational vessels, as well as gas taxes. Additionally, the DBW's recreational vessel turn-in program allows owners to surrender their vessels to a public agency for

free disposal. Daly noted that it is much less expensive for the state to process a vessel that has been handed over through this program than it is to remove and deal with abandoned vessels. A large part of the increased costs is associated with the release or spill of hazardous chemicals.

### **Summary of Poster Presentation at the 2017 Delta Invasive Species Symposium**

#### **Risky Business: Comparative Nonindigenous Species Risk from Vessels at Bay-Delta Ports. Raya Nedelcheva, Jonathan Thompson, and Nicole Dobroski. Marine Invasive Species Program, California State Lands Commission.**

The global increase in introductions of nonindigenous species in coastal waters has been rising steadily over the past 200 years. One of the most substantial pathways of introduction is via commercial cargo ships, both from their ballast water and from organisms that live on their hulls; collectively these two pathways make up 81 percent of the new invasive species introductions in California. This study focused on commercial shipping activities at seven port zones in the San Francisco Bay-Delta, one of the most invaded coastal water bodies in the world and where approximately 65 percent of California's marine invasive species are first detected.

Researchers evaluated commercial shipping vessels on their arrival, focusing on ballast water management strategies and biofouling management patterns to understand the vessels' potential for introducing nonindigenous species into the Bay-Delta. The study found that from 2008-2015 the number of vessels complying with the hull husbandry requirements increased 30 percent and that most vessels arriving in San Francisco Bay and Delta ports have anti-fouling coatings that are less than two years old (an important consideration as effectiveness of the coating greatly decreases with age). Out of 32,400 vessels that arrived in the seven Bay-Delta ports from 2008-2016, 82 percent retained their ballast water, a management approach that reduces the risk of introduction of new invasive species. While results from this study are encouraging, the State Lands Commission is currently working on additional efforts to increase compliance with existing management practices, as well as developing novel management strategies. For example, a feasibility study of shore-based ballast water reception and treatment facilities in California is being prepared and independently reviewed with assistance from the Delta Science Program.

### **Summary and Highlights from the Workshop on Structured Decision Making**

The United States Bureau of Reclamation (Reclamation) recently approached the Council's Delta Science Program for assistance in facilitating a SDM effort with representatives from the Delta Plan Interagency Implementation Committee (DPIIC) agencies and stakeholders. Based on decision theory and risk analysis, the SDM is the general term for a process that organizes and evaluates issues in order to reach efficient and transparent decisions for agreed upon objectives. Reclamation has been using the SDM for their Central Valley Project Improvement Act (CVPIA) decisions for the past two to three years. Building on the CVPIA SDM effort, Reclamation requested that the Delta Science Program help facilitate a similar effort for making science-based decisions in the Delta.

In May 2017, staff from the Council began outreach to get buy-in and commitments from various agencies and other stakeholders for a pilot Delta SDM effort. At a kick-off workshop on Aug. 16, 2017, 25-30 participants met to receive training on the SDM process led by Dr. Jim Peterson (U.S. Geological Survey and Oregon State University). The group also worked to create a mission statement for the Delta SDM effort. A second workshop will be held in early to mid-November to develop objectives and a process by which priorities can be evaluated for Reclamation's Bay-Delta Office.

### **Update on Operation Baseline**

Beginning in 2019, the Sacramento Regional County Sanitation District (Regional San) wastewater treatment plant will undergo \$1.6 billion in upgrades. These upgrades will dramatically reduce total nitrogen levels and alter the chemical form of nitrogen in the Sacramento River. To understand what effects these changes will have on the Delta ecosystem, a baseline of chemical and biological conditions needs to be established prior to treatment upgrades. Operation Baseline is a set of innovative pilot studies funded by the Council to fulfill this need. The studies will assess the current state of nutrients, aquatic vegetation, and the food web in areas that will be affected by the improvements to the wastewater treatment plant. These studies lay the groundwork for enabling comparisons between present and future conditions, including shifts in harmful algal blooms (HABs) and excessive growth of aquatic plants.

Sampling for Operation Baseline is scheduled to begin this month. This will include the collection of a wide range of environmental data, from water chemistry to the food web. The initial phase of Operation Baseline will also test new equipment to continuously measure ammonia and phytoplankton community composition along the Sacramento River. Isotopic analyses will inform how nutrients can be traced from their source to the food web in the Bay-Delta. Additional research is being planned for spring 2018 that will focus on understanding nutrient conditions and the base of the food web in shallow tidal wetland habitat.

The first of three informational meetings on the Operation Baselines studies will be held from 9:00 p.m. to 12:30 p.m. on Oct. 30, 2017 at the Park Tower conference center in Sacramento. At this public meeting the project investigators will present their research goals and study plans. The meeting will be an opportunity for scientists, stakeholders, and the public to exchange information and discuss critical science occurring in the Delta. To view the agenda for the informational meeting please visit: <http://deltacouncil.ca.gov/event-detail/15008>.

### **Upcoming Symposium on Informing Delta Management Using Biotelemetry**

On Thursday, Nov. 9, 2017, the University of California, Davis' Klimley Biotelemetry Lab and Cramer Fish Sciences, in conjunction with the Council's Delta Science Program will host a Delta Biotelemetry Symposium. The symposium will take place at the UC Davis Student Community Center and is intended for researchers and managers who want to discuss the results of recent telemetry studies, work through technical challenges of telemetry use, and gain insights into telemetry study designs. The all-day symposium will include five sessions and will explore topics such as the use of telemetry to explain fish behavior in wetland habitats. Each session will conclude with a moderated panel

discussion. For more information about the event please visit:  
<http://www.deltacouncil.ca.gov/event-detail/14838>.

### **By the Numbers**

Staff will give a summary of current numbers related to Delta water and environmental management. The summary (Attachment 1) will inform the Council of recent counts, measurements, and monitoring figures driving water and environmental management issues.

### **List of Attachments**

Attachment 1: By the Numbers Summary (*report to be provided at the Council meeting*)

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